UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/774,883	02/09/2004	Ryan Fung	ALT.P027 (A1182)	8816

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EXAMINER
KIK, PHALLAKA

ART UNIT	PAPER NUMBER
2825	

DATE MAILED: 08/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/774,883	FUNG ET AL.
	Examiner	Art Unit
	Phallaka Kik	2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>22 May 2006</u>.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>15-17,23-42,44-69,72 and 73</u> is/are pending in the application, *wherein claims 1-14, 19-22, 43, 70-71 are cancelled.*

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) <u>15-17 and 23-25</u> is/are allowed.

6)☒ Claim(s) <u>26-42,44-69,72 and 73</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on <u>09 February 2004</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____ .

U.S. Patent and Trademark Office

PTOL-326 (Rev. 7-05)   Office Action Summary   Part of Paper No./Mail Date 20060821

DETAILED ACTION

1.   This Office Action responds to the Applicant's amendment filed on 5/22/2006.

Claims 15-17,23-42,44-69,72-73 are pending, wherein claims 1-14,18-22,43,70-71 have

been cancelled, and claims 15-17,23,25-28,32-33,37-38,41-42,44,59,68-69 have been

amended, and claims 72-73 are newly added. Claims 15-17,23-42,44-69,72-73 have

been examined; wherein as per claims 15-17,23-25, the claims are allowed; and as per

claims 26-42,44-69,72-73, Applicant's arguments are not persuasive; therefore, the

previous Office Action is incorporated herein.

Claim Objections

2.   **Claims 33,38** are objected to because of the following informalities:

As per **claim 33**, "weighting" (line 1) should be --weightings-- for proper

antecedent basis; --before-- should be inserted before "all" (line 2) for greater

clarification.

As per **claim 38**, "weighting" (line 1) should be --weightings-- for proper

antecedent basis.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out
and distinctly claiming the subject matter which the applicant regards as his
invention.

4.   **Claims 68-69** are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention, wherein the claims are indefinite because they

depend on now cancelled claims 13 and 21 respectively.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

5.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a
foreign country or in public use or on sale in this country, more than one year
prior to the date of application for patent in the United States.

6.   **Claims 26-29,34,39-42,44,46-47,53-62,65,68-69,72-73** are rejected under 35

U.S.C. 102(b) as being anticipated by **Bennett et al.** (U.S. Patent No. 5,659,484).

As per **claims 26,59**, the short path and long path timing constraints are

described in col. 13, line 5 to col. 14, line 2, wherein at least the PERIOD,

FREQUENCY, MAXDELAY, MAXSKEW, and OFFSET constraints correspond to the

long path timing constraints (see Applicant's specification, page 9, lines 20-21 and page

1, lines 16-19), and wherein at least the OFFSET/BEFORE, OFFSET IN/AFTER,

OFFSET OUT/AFTER, OFFSET OUT/BEFORE, and BLOCK constraints correspond to

the short-path timing constraints (see Applicant's specification, page 9, lines 21-23);

wherein the minimum and maximum delay budgets generated based on these timing

constraints are further described in col. 18, line 1 to col. 19, line 61; and wherein such

designing of the system based on the minimum/maximum delay budgets are part of the

placement and routing algorithms used which applied these delay budgets (see col. 26,

line 53 to col. 30, line 20; see also col. 10, line 48 to col. 11, line 32); wherein since the

calculations of the minimum/maximum delay budgets are based on at least some

common variables (i.e., sumdelay, path.numconns, conn.delay being used for both the

mintarget and maxtarget--col. 19, lines 30-60) and the both the conn.mindelta and

conn.maxdelta (components of the calculation of minimum/maximum delay budgets

mintarget and maxtarget respectively) must be zero to end the recursive timing budget

relaxation (see col. 20, lines 59-67), the minimum and maximum delay budgets are

accordingly computed at least indirectly and/or directly in consideration of each other;

and wherein machine-readable medium having stored thereon sequences of

instructions when executed by a processor, causes the processor to implement the

recited steps are also part of the computer-implemented system as described in col. 9,

line 39 to col. 10, line 12 (see also Fig. 8).

As per **claims 27-29,34,39-40,60-62,65**, all of the elements of claims 1,18,26,59,

from which the respective claims depend, are discussed in the rejection of claims

1,18,26,59 above, wherein the generating of the minimum/maximum delay budgets

comprising finding a set of connection delays that attempt to satisfy the short/long path

timing constraints, allocating short/long path slack (values), determining short/long path

slack values, fixing any short/long path timing constraint violations (i.e., by making sure

the timing constraints are satisfied), are also described in col. 18, line 1 to col. 19, line

60.

As per **claim 41**, all of the elements of claim 34, from which the claim depends,

are discussed in the rejection of claim 34 above, wherein repetitions or iterations of

performing timing analysis, allocating slacks, and determining minimum and maximum

delay budgets are illustrated in Figs. 5a-5b, 6a-6c (see also col. 18, line 46 to col. 21,

line 65).

As per **claims 42,44**, all of the elements of claim 26, from the claims depend, are

discussed in the rejection of claim 26 above, wherein the maximum delay budget is

greater or equal than the minimum delay budget, the minimum and maximum delay

budgets are determined in consideration of each other, and optimizing some function of

the distance (i.e., range) of the minimum and maximum delay budgets, are also part of

the determining the target delay values (i.e., mintarget and maxtarget) as described in

col. 18, line 1 to col. 21, line 65, wherein target relaxation balances optimizes the

range/distance between the minimum and maximum delay budgets as well as taking in

consideration of each other, wherein by definition the maximum delay budget must be

greater or equal than the minimum delay budget in order to satisfy the proper timing

constraints.

As per **claims 46-47,53-58**, all of the elements of claim 26, from the claims

depend, are discussed in the rejection of claim 26 above, wherein the generating of the

placement and routing strategy in response to the maximum and minimum delay

budgets are described in col. 26, line 52 to col. 30, line 25, wherein since the FPGA into

which the circuit design is to be implemented, contains dedicated routing resources

including buffers (see col. 8, lines 21-50), the use of placement and routing which

involves the use of dedicated routing resources, placement distances,

increasing/decreasing delays, using more or fewer routing resources, using slower or

faster routing resources, using buffers to slow down or speed up routes, are also within the scope of the placement and routing that attempts to meet the desired delay budgets and timing constraints as further described in col. 10, line 35 to col. 11, line 27.

As per **claims 68-69**, the delay budgets being determined by starting with estimates of final connection delays, and the upper and lower limits on connection delay being based on estimates of possible delays in the final system and/or values that improve the quality of the system being design, are within the scope of **Bennett et al.** since the delay budgets (i.e., as calculated from slack values) uses both delay calculator for determining actual delays from existing routing and delay predictor which determines the estimated delays (see col. 10, lines 55-65) and wherein the mintarget and maxtarget computations are repetitively refined to arrive at a final system or at values that improve the quality of the system being designed as described in col. 19, lines 30-61 (see also col. 18, line 1 to col. 19, line 30).

As per **claims 72-73**, all of the elements of claim 26 from which the claims depend are discussed in the rejection of claim 26 above, wherein the delay budgets respects lower and upper limits on connection delay are part of the mintarget and maxtarget computations as described in col. 19, lines 30-61 (see also col. 18, line 1 to col. 19, line 30).

Claim Rejections - 35 USC § 103

7.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the

subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8.   **Claims 30-33,35-38,63-64,66-67** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bennett et al.** (U.S. Patent No. 5,659,484) in view of **Frankle et al.** (U.S. Patent No. 5,521,837).

As per **claims 30-33,35-38,63-64,66-67, Bennett et al.** disclose all of the elements of claims 29,34,62,65 from which the respective claims depend. However, **Bennett et al.** fails to teach the steps of adding/subtracting the delay in response to the short-path slack values and connection weightings (including weightings determined by a unit weighting scheme and weighting based on how much delay can be added/subtracted before a practical limit is reached or all relevant violations are resolved or allocated). **Frankle et al.** teach the use of connection weightings and slack values as part of the adjustment (i.e., by adding or subtracting) of the upper and lower limits delay (col. 13, line 15 to col. 16, line 20) such that limits on connections with negative slack are adjusted own and those with positive slack are adjusted up; thus providing the most optimized limits to meet the tighter path constraints (col. 10, lines 40-50; col. 9, lines 48-63), wherein since Applicant's specification does not specifically define the "unit weighting scheme", the weight f(c) calculated by dividing by the max weights satisfy this criterion (see col. 15, lines 40-45). It would have been obvious to one of ordinary skilled in the art at the time of the invention to further incorporate the use of connection weightings and slack values as part of the adjustment (i.e., by adding

or subtracting) of the upper and lower limits delay as taught by **Frankle et al.** into the

method/system of **Bennett et al.** because such incorporation would provide the most

optimized delay limits (i.e., delay budgets) as taught by **Frankle et al.** while at the same

time meeting the particular short/long paths timing constraints as taught by **Bennett et

al.**.

9.   **Claims 45,48-52** are rejected under 35 U.S.C. 103(a) as being unpatentable

over **Bennett et al.** (U.S. Patent No. 5,659,484) in view of **Rostoker et al.** (U.S. Patent

No. 5,541,849).

As per **claims 45,48-52, Bennett et al.** disclose all of the elements of claim 26,

from which the claims depend. However, **Bennett et al.** failed to particularly teach the

generating of a synthesis strategy in response to the maximum and minimum delay

budgets, including whether to add or remove levels of logic, whether to use slower or

faster variants of a functional block, whether to use faster or slower logic structures, and

whether to use faster or slower logic inputs. **Rostoker et al.** a method/system for

designing a circuit involving various levels of optimizations (see col. 9, line 60 to col. 12,

line 23) including for ASICs and PLDs (see col. 48, line 61 to col. 49, line 4) which

includes various synthesis strategies which take into consideration timing constraints,

logic optimization (i.e., adding or removing levels of logic, using the particular functional

block/logic structures/logic inputs, optimized for speed, area, or power) (see col. 10, line

63 to col. 11, line 2; col. 11, lines 18-45). It would have been obvious to one of ordinary

skilled in the art at the time of the invention to further incorporate the various synthesis

strategies as taught by **Rostoker et al.** into the system/method of **Bennett et al.**

because such incorporation would further optimize the resulting circuit design

implementation as taught by **Rostoker et al.** while meeting the desired timing

constraints as taught by **Bennett et al.**.

Allowable Subject Matter

10.   **Claims 15-17,23-25** are allowed.

The following is a statement of reasons for the indication of allowable subject

matter:

As per **claims 15-17**, Applicant's amendment and arguments filed on 5/22/2006

set forth the patentability of Applicant's claimed invention, wherein as pointed out by

Applicant, the prior arts made of record failed to teach or suggest generating minimum

delay budgets for connections from short-path timing constraints, wherein generating

the minimum delay budgets for connections comprises allocation of positive and

negative slack using successive-over-relaxation where more slack than is available is

allocated, as now claimed (see Applicant's amendment filed on 5/22/2006, pages 14-

15).

As per **claims 23-25**, Applicant's amendment and arguments filed on 5/22/2006

set forth the patentability of Applicant's claimed invention, wherein as pointed out by

Applicant, the prior arts made of record failed to teach or suggest generating maximum

delay budgets for connections from long-path timing constraints, wherein generating the

maximum delay budgets for connections comprises allocation of positive and negative

slack using successive-over-relaxation where more slack than is available is allocated,

as now claimed (see Applicant's amendment filed on 5/22/2006, pages 14-15).

Remarks

11.   The objections of **claims 6-7,10-13,15-17,21,23-25,27-28,32,34-37,39-44,61,65-71** are withdrawn in light of Applicant's amendment filed on 5/22/2006, which either corrected the informalities, muted the informalities due to the cancellation of the claims or overcome the informalities due to the persuasive arguments presented. However, as per **claims 33,38**, the claims still contain the noted informalities since Applicant only partially corrected the errors.

12.   As per **claims 68-69**, the claims are newly rejected to as being indefinite as being necessitated by Applicant's amendment to the claims, wherein the claims now depend on cancelled claims.

13.   The rejections of **claims 1-4,8,12-16,18-24,43,70-71** under 35 U.S.C. 102(b) as being anticipated by **Bennett et al.** (U.S. Patent No. 5,659,484) are withdrawn in light of Applicant's amendment filed on 5/22/2006, wherein claims 1-4,8,12-14,18-22,43,70-71 have been cancelled and claims 15-16,23-24 are allowed for the reasons indicated above.

14.   The rejections of **claims 5-7,9-11,17,25** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bennett et al.** (U.S. Patent No. 5,659,484) in view of **Frankle et al.** (U.S. Patent No. 5,521,837) are withdrawn in light of Applicant's amendment filed on 5/22/2006, wherein claims 5-7,9-11 have been cancelled and claims 17,25 are allowed for the reasons indicated above.

15.   As per **claims 26-42,44-67,72-73**, Applicant argued that neither **Bennett et al.** (U.S. Patent No. 5,659,484), **Rostoker et al.** or **Frankle et al.** (U.S. Patent No.

5,521,837) teach the minimum and maximum delay budgets determined such that at

least one of the minimum delay budgets and maximum delay budgets is determined

with consideration of the other, as claimed, but are rather determined independently of

each other. The Examiner is not persuaded. Although **Bennett et al.** teaches the

minimum and maximum delay budgets (mintarget and maxtarget) are independently

calculated as pointed out by Applicant, such calculations of the minimum/maximum

delay budgets are based on at least some common variables (i.e., sumdelay,

path.numconns, conn.delay being used for both the mintarget and maxtarget--col. 19,

lines 30-60) and the both the conn.mindelta and conn.maxdelta (components of the

calculation of minimum/maximum delay budgets mintarget and maxtarget respectively)

must be zero to end the recursive timing budget relaxation (see col. 20, lines 59-67).

Therefore, the minimum and maximum delay budgets are accordingly computed at least

indirectly and/or directly in consideration of each other.

Conclusion

16.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure. Therefore, Applicant is herein requested to consider them

carefully in response to this Office Action.

17.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

18.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Phallaka Kik whose telephone number is 571-272-1895.

The examiner can normally be reached on Monday-Thursday, 8:30AM-7PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Jack Chiang can be reached at 571-272-7483. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

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For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

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Any response to this action should be mailed to:

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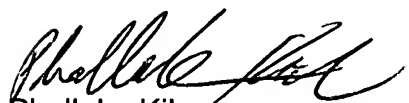
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